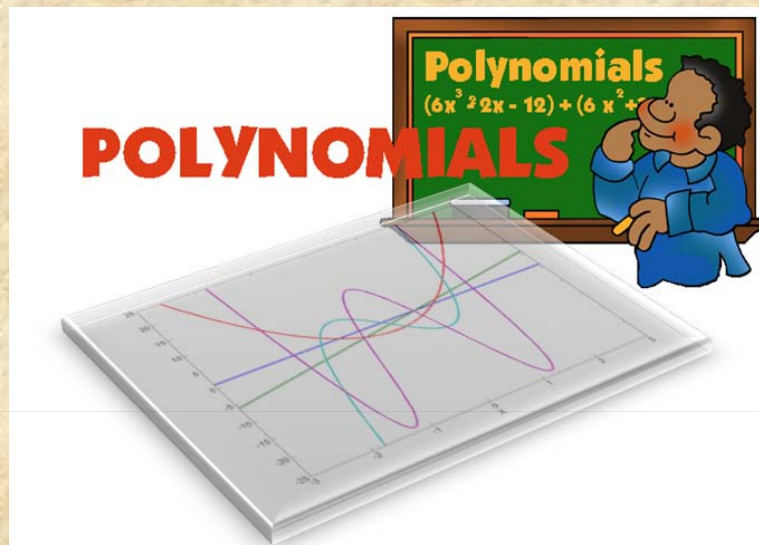


Grade 11 Core Term 2 Project



$$\begin{aligned} & x^2 + 7x - 3 \\ & 4a^3 + 7a^2 + a \\ & nm^2 - m \\ & 3x - 2 \\ & 5 \end{aligned}$$



Student Name: _____ Section: 11. _____

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(Groups of 4 students only)

Due Date: _____

Introduction

In this project the polynomial functions are used to model real-world data. A good model must consistently provide answers to the question or problem it was created to solve. In your project, you will predict the shape of containers by using polynomial models that are created from the relationship between the volume of water contained and the height of water in the container.

The project has four tasks:

Task 1: Collect and organize the data

Task 2: Determine a polynomial model that best fits a data set

Task 3: Test your polynomial model

Task 4: Present a video with your model

Task 1:

- Get a bottle with a circular base, a flat bottom, and curved sides. Measure the diameter of the circular base in centimeters. Calculate the radius.
- Pour water into the bottle until the bottle is approximately half full. Place a cap on the bottle, and measure the height h_1 of the water, in centimeters. The volume W in milliliters of the part of the bottle containing water can be approximated by

$$W(r) = \pi r^2 h_1.$$

Calculate the approximate volume of this part of the bottle.

- Turn the bottle upside-down and measure the height h_2 of the air above the water, in centimeters. The volume A in milliliters of the air space can be approximated by

$$A(r) = \pi r^2 h_2.$$

- The total volume of the of the bottle in milliliters can be modeled by the polynomial function in variable r :

$$V(r) = W(r) + A(r) = \pi r^2 h_1 + \pi r^2 h_2.$$

Find the total volume of the bottle V .



Task 2:

1. Using a software at your choice, graph each function in a xy coordinate plane. For each function, answer questions a and b below.

$$f(x) = x^2 - 2x + 1$$

$$g(x) = x^3 - 3x + 2$$

$$h(x) = -x^4 + 4x - 3$$

$$j(x) = -x^5 + 5x - 4$$

- a. Describe the end behavior of each graph and state whether the degree of the function is even or odd.
 - b. Find the number of real zeros for each function.
2. Referring to the bottle from Task 1, if the height h_1 is 1 unit less than the radius r , and the height h_2 is 2 less than the radius r , write the polynomial function for the total volume $V(r)$ in terms of r .
 3. Graph the function that you find in step 2.
 4. Compare the graph from step 3 to the graphs from step 1. How are they alike? How are they different?



Task 3:

In task 1 you took measurements and made calculations to find a polynomial model for a cylindrical container with a flat circular base. Now you will find a model for the volume of a bottle with a different shape.

- 1. Obtain a bottle with a flat square base. Fill the bottle about halfway with water.**
- 2. Write a function that approximates the volume, in milliliters, of the part of the bottle containing water, W .**
- 3. Turn the bottle upside-down, and write a function that approximates the volume, in milliliters, of the air space in the bottle, A .**
- 4. Write a function that models the total volume, in milliliters, of the bottle, V .**
- 5. Suppose that the height of the water is equal to length of each side of square base. If the height of the air space above the water is 2 centimeters, what side length of the base will give a total volume of 96 milliliters?**

Task 4:

- 1. Prepare a video that contains the work done in tasks 1 and 3.**
- 2. Print out the project, showing the evidence of all the measurements from tasks 1 and 3 and the graphs that are required in task 2.**
- 3. Print out the rubrics.**

Rubrics

	Criteria				Points
	100% of task mark	75% of task mark	50% of task mark	25% of task mark	
Completeness of Tasks 4 marks	Tasks are totally completed and correct.	Tasks are partially completed, OR Partially wrong	Tasks are partially completed, AND Partially wrong	Tasks are Attempted	—
Presentation and Integration of Technology 14 marks	Students used one mean of technology. The tool used helped the student and was useful to support his project. Moreover, the student was able to explain the work he/she submitted confidently and fluently; he/she was able to answer all of colleagues and instructor's questions	Student used a mean of technology but it was not that supportive to the topic. In addition, student was able to explain the work he/she submitted confidently and fluently and he/she reflected an understanding of his/her works. The student was able to answer most of colleagues and instructor's questions.	Student was able to explain the work he/she submitted. Student reflected a shallow understanding of his/her work; she was able to answer some of colleagues and instructor's questions,	Student use of technology was primitive and way below the level of other IAT students. Student was unable to explain the work he/she submitted. Student reflected no understanding of his/her work; he/she was unable to answer any of colleagues and instructor's questions.	—
Creativity& enrichment 2 marks	Student had an outstanding addition in all aspects of his/her project.	Student had an outstanding addition in some aspects of his/her project.	Student had an outstanding addition in very few aspects of his/her project.	Student had an outstanding addition in no aspects of his/her project.	—
Total mark out of 20				Total---->	—